

CLAIMS :

1. A type of particulate reinforced aluminum-based composite which
5 comprises reinforced particles and aluminum alloy, wherein:
 - (1) the reinforced particles are dispersively and uniformly distributed
in an aluminum alloy matrix, and forms interfacial bonding with the
matrix;
 - (2) the average particle size of the reinforced particles is
10 0.1~3.5 μ m; and
 - (3) the volume percentage of the reinforced particles is 10 ~ 40%.
2. A type of particulate reinforced aluminum-based composite as claimed
in claim 1, wherein the reinforced particle in question is selected from the
15 group consisting of B₄C, SiC, Al₂O₃ and AlN.
3. A type of particulate reinforced aluminum-based composite as claimed
in claim 1, wherein the aluminum alloy is selected from the group consisting of
forged aluminum, duralumin and super duralumin.
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4. A type of particulate reinforced aluminum-based composite component,
wherein the component is made from a billet of the particulate reinforced
aluminum-based composite as claimed in claim 1.
- 25 5. A method of forming a type of particulate reinforced aluminum-based
composite component comprising the steps of:
 - (1) according to a desired volume percentage of reinforced
particles in an aluminium-based composite, determining a weight
percentage of the required reinforced particles;
 - 30 (2) based on the required weight percentage of reinforced particles
in the composite, determining a required weight of the reinforced
particle and corresponding weight of an aluminum alloy powder;

- (3) loading required amounts of reinforced particles, Al-based alloy powder and steel balls into a balling drum of a high-energy ball-mill, then carrying out high-energy ball-milling to form a composite powder;
- (4) adding liquid surfactant, and continuing with ball-milling;
- 5 (5) molding the composite powder into a desired shape through cold isostatic pressing;
- (6) processing the cold isostatic pressed shape into a compact billet by means of vacuum sintering or vacuum hot-pressing; then
- (7) heating the compact billet, and undertaking semisolid die-cast forming to produce a near net shape composite component.
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6. A method as claimed in claim 5, wherein the volume percentage of reinforced particles is 10~40% and the weight percentage of reinforced particles is 9.3~50.9%.

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7. A method as claimed in claim 5, wherein high-energy ball-milling is performed for 1~10 hours and a ball to power weight ratio is 10-50:1.

8. A method as claimed in claim 5, where the high-energy ball-milling is divided into a low speed stage wherein a rotational speed is 100~150rpm for 10~40 minutes, and a high speed stage wherein a rotational speed is 150~300rpm for 20~600 minutes.

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9. A method as claimed in claim 5, wherein after adding liquid surfactant, ball-milling is continued for 0.5~2 hours within a temperature range of 15~80°C.

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10. A method as claimed in claim 5, wherein the compact billet has a density of 70~80% of its theoretical density, and is formed by applying a pressure of 20~1000 MPa for 1~10 minutes.

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11. A method as claimed in claim 5, wherein the vacuum sintering or vacuum hot-pressing is carried out at a temperature of 450~600°C, pressure of 36~700Mpa and vacuum degree of not less than 1.5×10^{-2} Pa.

5 12. A method as claimed in claim 5, wherein the compact billet is heated to 600~660°C to reach a 60~70% liquid phase content.

13. A method as claimed in claim 5, wherein the reinforced particle is selected from the group consisting of B₄C, SiC, Al₂O₃ and AlN.

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14. A method as claimed in claim 5, wherein the aluminum alloy is selected from the group consisting of forged aluminum, duralumin and super duralumin.

15 15. A method as claimed in claim 5, wherein the average size ratio between the said reinforced particle and the Al-base alloy powder can be selected randomly within a range of 0.1~100μm/10~210μm.

16 16. A method as claimed in claim 5, wherein the steel balls are high-carbon steel balls of Φ5~Φ8mm.

17 17. A method as claimed in claim 5, wherein the balling drum is first vacuumized to a vacuum degree of 0.1~10Pa, then an inert gas of nitrogen or argon is added at a pressure of 1.01×10^5 Pa~ 1.1×10^5 Pa, and the balling drum undertakes high-energy ball-milling with cooling of 5~25°C.

18 18. A method as claimed in claim 5, wherein the amount of the added surfactant is 10 — 50ml.

30 19. A method as claimed in claim 18, wherein during the ball-milling process, the balling drum is first vacuumized to a vacuum degree of 0.1~10Pa, then an inert gas of nitrogen or argon is added at a pressure of

$1.01 \times 10^5 \text{Pa} \sim 1.1 \times 10^5 \text{Pa}$, and the balling drum undertakes high-energy ball-milling without cooling.

20. A method as claimed in claim 5, wherein the particle size range of the composite powder after the high-energy ball-milling is 10—120 μm .

21. A method as claimed in claim 5, wherein the added surfactant is an organic solvent selected from the group consisting of gasoline, aviation gasoline, methanol and ethanol.

22. A method as claimed in claim 5, wherein the compact billet is shaped by means of semisolid die-casting after it is heated.